**Lecture: Myoglobin and Hemoglobin / Dignam**

1. Compare the structures of Hb and Mb.

|  |  |  |
| --- | --- | --- |
| **Protein** | **Myoglobin** | **Hemoglobin** |
| **Subunit shape/structure** |  |  |
| **# of Subunits** |  |  |
| **# of O2 sites** |  |  |

2. Define Kd: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Use arrows to indicate increasing/decreasing:

1. At 🡩 Kd, the affinity of Mb for O2 is \_\_\_
2. At \_\_\_ Kd, the affinity of Mb for O2 is \_\_\_.

3. Hill equation

*n* = Hill coefficient = minimum number of classes of sites; index to degree of cooperativity in a system

|  |  |  |  |
| --- | --- | --- | --- |
| **Value of *n*** | **K1 ? K2** | **Cooperativity** | **Description** |
| =, <, or > | None, positive, or negative |
| n = 1 | K1 K2 |  | Only one binding site or independent binding |
| n > 1 | K1 K2 |  | Occupation of first site makes binding in second site more favorable |
| n > 2 | K1 K2 |  | Occupation of first site makes subsequent binding in second site less favorable |

5. Given the slope of a double-reciprocal plot, how would you determine Kd? What other information would you need?

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

6. Heterotrophic and homotropic allosteric effectors. Identify the following scenarios as homotropic or heterotropic.

a. \_\_\_\_\_\_\_\_\_\_\_\_\_ H+ binding to His 146 alters O2 binding to the hemes on α and β subunits (Bonus: what effect is this? \_\_\_\_\_\_\_\_\_\_)

b. \_\_\_\_\_\_\_\_\_\_\_\_ 2,3-BPG binding to center of Hb tetramer alters binding of O2 to hemes on α and β subunits

c. \_\_\_\_\_\_\_\_\_\_\_\_ CO2 reacting with N-terminal alters binding of O2 to heme

d. \_\_\_\_\_\_\_\_\_\_\_\_ O2 binding on one subunit affects O2 binding on another subunit

e. \_\_\_\_\_\_\_\_\_\_\_\_ O2 binding to heme promotes release of CO2 from N-terminal (Bonus: what effect is this? \_\_\_\_\_\_\_\_\_\_\_\_)

7. How many molecules of 2,3-BPG can Hb bind?

a. One

b. Four

c. None

d. Two, only on alpha subunits

e. Two, only on beta subunits

8. Which model(s) accounts for both positive and negative cooperativity?

a. Monod

b. Koshland

c. Concerted Model

d. Sequential Model

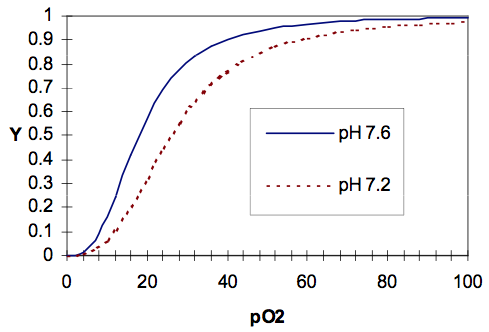
e. All of the above

f. Only a, c, and d

g. Only b and d

h. Only a and d

9. Use the image to answer the following questions:



1. The solid line has (circle one) higher / lower concentration of H+ compared to the dotted line
2. The pH of the dotted line is (circle one) higher / lower compared to the pH of the solid line
3. If the lines represented maternal and fetal Hb, which line represents HbF (circle one)? Dotted / solid

10. When you 🡩 temperature, what is the effect on the binding affinity of Hb for O2? 🡩 or 🡫?

11. Hb effectors

|  |  |  |  |
| --- | --- | --- | --- |
| **Ligand** | **Effect on O2 affinity**  (🡩 or 🡫) | **Effect of binding**  (Homo/heterotropic) | **Stabilized State**  (R or T) |
| 1. O2 |  |  |  |
| 2. |  |  |  |
| 3. |  |  |  |
| 4. |  |  |  |